

Development of Planetary Protection Technology:
Lanthanide Luminescence for Real Time Bacterial Spore Detection

Adrian Ponce¹ and Kasthuri Venkateswaran¹

¹Jet Propulsion Laboratory, Pasadena CA 91109

Dipicolinic acid (DPA, 2,6-pyridinedicarboxylic acid) is present in high concentrations (~1 molar or ~15% of dry weight) in the core of bacterial spores as a 1:1 complex with Ca^{2+} . DPA is unique to bacterial spores and is released into bulk solution upon germination. Thus, DPA is an indicator molecule for the presence of bacterial spores. Fortuitously, DPA is also a classic inorganic chemistry ligand that binds metal ions with high affinity. DPA binding to terbium ions triggers intense green luminescence under UV excitation. Thus, the green luminescence turn-on signals the presence of bacterial spores, and the intensity of the luminescence can be correlated to the number of endospores per milliliter. The current detection limit for this method is 10^4 spores/ml. We will present our recent efforts to improve the sensitivity towards the single spore per milliliter detection limit.